University of Asia Pacific
Department of Civil Engineering
Final Examination Fall 2016
Program: MCE

Course No: CE 6301
Full Marks: 100

Course Title: Theory of Water Treatment
Time: 3.0 hour

Answer all the questions.

[Assume reasonable value of missing data (if any)]

1. Discuss physical, chemical, microbiological and radiological characteristics of water. [6]
2. Discuss the aeration process of water treatment. [4]
3. Define adsorption, absorption, adsorbate, adsorbent. [4]
4. What are the common analyses that need to perform for characterizing raw water? [4]
5. Mention the types of i) Dry chemical feeder ii) Liquid chemical feeder. [4]
6. Determine the alum storage volume required for the following conditions: [8]
   Average water demand = $0.2\ m^3/s$
   Maximum dosage = 60 mg/L as alum
   Shipping time = 1 week
   Alum is a noninterruptible chemical.
7. Draw the sketch of natural process by which water is made hard. [4]
8. Describe the purposes of recarbonation. [4]
9. Explain i) Split Treatment with diagram ii) Chemical disinfectant kinetics. [6]
10. What are the constituents that concurrently remove during water softening process? [2]
11. Given the following analysis of a groundwater, construct a bar chart of the constituents, expressed as $CaCO_3$. [8]

Ion	mg/L as ion
Ca^{2-}	103
Mg^{2-}	5.5
Na^{-}	16
HCO_3^{-}	255
SO_4^{2-}	49
Cl^{-}	37

12. Mention the types of settling properties of particles that considered in sedimentation theory. [4]
13. Mention the name of five agents have found commonly use in disinfecting process. Also mention the disinfection byproducts that results from disinfection processes. [8]

14. A water sample has an alkalinity of 200 mg/L as $CaCO_3$. The Ca^{2-} concentration is 160 mg/L as the ion, and the Mg^{2-} concentration is 40 mg/L as the ion. The pH is 8.1. Find the total, carbonate, and noncarbonate hardness. [8]

15. Mention the treatment strategies of Arsenic removal from water. Describe the peroxidation processes for Arsenic treatment strategies with Ozone. [8]

16. Explain the fundamental percepts in drinking water plant process selection. [4]

17. Show the Mechanisms of granular filtration through sketches only. [4]

18. A sand filter is to be designed for the Ottawa Island's new water treatment plant. A sieve analysis of the local island sand is given below. Using the sand analysis, find the effective size, E, and uniformity coefficient, U. Also estimate i) the clean filter headloss and determine if it is reasonable ii) number of filters. Use the following assumptions: loading rate is 216 $m^3/d * m^2$, specific gravity of sand is 2.65, the shape factor is 0.82, the bed porosity is 0.45, the water temperature is 10 C, the depth of sand is 0.5 m., maximum design flow rate is 25000 m^3/d. [10]

U. S. Standard Sieve No.	Analysis of Stock Sand (Cumulative Mass % Passing)
140	0.2
100	0.9
70	4.0
50	9.9
40	21.8
30	39.4
20	59.8
16	74.4
12	91.5
8	96.8
6	99.0

University of Asia Pacific
Department of Civil Engineering
Final Examination Fall 2016
Program: Master in Civil Engineering

Course Title: Soil Mechanics I | Course Code: CE 6401
Time: 3 hours | Full Marks: 100

Part A

Answer the following questions.

1. Answer any 6 questions: **4*6=24**

(a) What is the most common soil exploration technique employed in Bangladesh? Judge the suitability of using these results in the design of foundation in different types (such as sand, clay) of soil?

(b) In which case(s) can punching shear failure of shallow foundation take place? How can ultimate bearing capacity of a shallow foundation be determined due to punching shear failure?

(c) In analyzing the results of unconfined compressive strength test, area correction is required. Why is it necessary?

(d) What kind of problem do you expect if a thin layer of organic clay was not detected during soil exploration?

(e) The structural distress is observed for the first time in the 10^{th} year after construction due to some problem related to foundation settlement.
Detect the possible cause(s) of the problem.
How can these problems be identified before construction?

(f) State the lateral earth pressure condition around the driven piles.

(g) Judge the performance of piles in collapsible soil during inundation.

(h) During a piezometer test, the water level in the piezometer is found above the ground water level. What is your judgment regarding the condition of soil due to foundation load?

2. In standard penetration test, borehole diameter = 120 mm; sampling method (Standard); γ_{sat} = 17.5 kN/m^3; rod length = 4.8 m. Water table is at the ground level.

(a) Determine the hammer efficiency, if the recorded blow counts are 4/5/5 for three consecutive 150 mm penetrations and $(N)_{70} = 9$. **5**

(b) Determine the missing blow count 'X' if the recorded blow counts are 4/X/6 for three consecutive 150 mm penetrations. The hammer efficiency is 0.55 and $(N)_{60} = 17$. **5**

(c) At a depth of 7 m, the recorded blow counts are 4/6/6 for three consecutive 150 mm penetrations. Calculate $(N_1)_{60}$. Apply the hammer efficiency determined in (a). **6**

3. Identify the soil parameters required in analyzing each type of foundation settlement. **10**

Part B

Answer one question from the following.

4. A 2 m wide strip footing, constructed at a depth of 1.5 m in sand.
The thickness of layer-1= 3 m.The saturated unit weights of dense sand and loose sand are 18 kN/m^3 and 15 kN/m^3. The water table is at 1.5 m below the GL.
Estimate the ultimate bearing capacity for the following cases:
   (a) Layer-1: $\varphi = 33°$ and Layer-2: $\varphi = 22°$ **22**
   (b) Layer-1: $\varphi = 22°$ and Layer-2: $\varphi = 33°$ **22**
Compare the results and mode of foundation failure in both the cases. **6**

5. A 2 m wide strip footing, constructed at a depth of 1.5 m in sand.
The thickness of layer-1= 3 m.The saturated unit weights of sand is 17 kN/m^3. The saturated unit weights of Clay(a) and Clay(b) are 17 kN/m^3 and 19 kN/m^3. The water table is at the foundation level.
Estimate the ultimate bearing capacity for the following cases: **22**
   (a) Layer-1: $\varphi = 30°$ and Layer-2: c = 22 kPa **22**
   (b) Layer-1: c = 55 kPa and Layer-2: c = 25 kPa **6**
Compare the results and mode of foundation failure in both the cases.

Variation of Meyerhof's Bearing Capacity Factors N_c, N_q, and N_γ

ϕ	N_c	N_q	N_γ	ϕ	N_c	N_q	N_γ	ϕ	N_c	N_q	N_γ
0	5.14	1 00	0.00	17	12.34	4.77	1.66	34	42.16	29.44	31.15
1	5.38	1.09	0.002	18	13.10	5.26	2.00	35	46.12	33.30	37.15
2	5.63	1.20	0.01	19	13.93	5.80	2.40	36	50.59	37.75	44.43
3	5.90	1.31	0.02	20	14.83	6.40	2.87	37	55.63	42.92	53.27
4	6.19	1.43	0.04	21	15.82	7.07	3.42	38	61.35	48.93	64.07
5	6.49	1.57	0.07	22	16.88	7.82	4.07	39	67.87	55.96	77.33
6	6.81	1.72	0.11	23	18.05	8.66	4.82	40	75.31	64.20	93.69
7	7.16	1.88	0.15	24	19.32	9.60	5.72	41	83.86	73.90	113.99
8	7.53	2.06	0.21	25	20.72	10.66	6.77	42	93.71	85.38	139.32
9	7.92	2.25	0.28	26	22.25	11.85	8.00	43	105.11	99.02	171.14
10	8.35	2.47	0.37	27	23.94	13.20	9.46	44	118.37	115.31	211.41
11	8.80	2.71	0.47	28	25.80	14.72	11.19	45	133.88	134.88	262.74
12	9.28	2.97	0.60	29	27.86	16.44	13.24	46	152.10	158.51	328.73
13	9.81	3.26	0.74	30	30.14	18.40	15.67	47	173.64	187.21	414.32
14	10.37	3.59	0.92	31	32.67	20.63	18.56	48	199.26	222.31	526.44
15	10.98	3.94	1.13	32	35.49	23.18	22.02	49	229.93	265.51	674.91
16	11.63	4.34	1.38	33	38.64	26.09	26.17	50	266.89	319.07	873.84

$q_u = q_b + \gamma_1 H^2 (1 + 2D/H) K_s \tan\varphi_1/B - \gamma_1 H \leq q_t$

q_b = the bearing capacity of a footing on a very thick bed of lower soil layer

q_t = the bearing capacity of a footing on a very thick bed of upper soil layer

$q_1 = (0.5\ \gamma_1 B\ N_{\gamma 1})$ or $(c_1\ N_c)$

$q_2 = (c_2 N_c)$ or $(0.5\ \gamma_2 B\ N_{\gamma 2})$

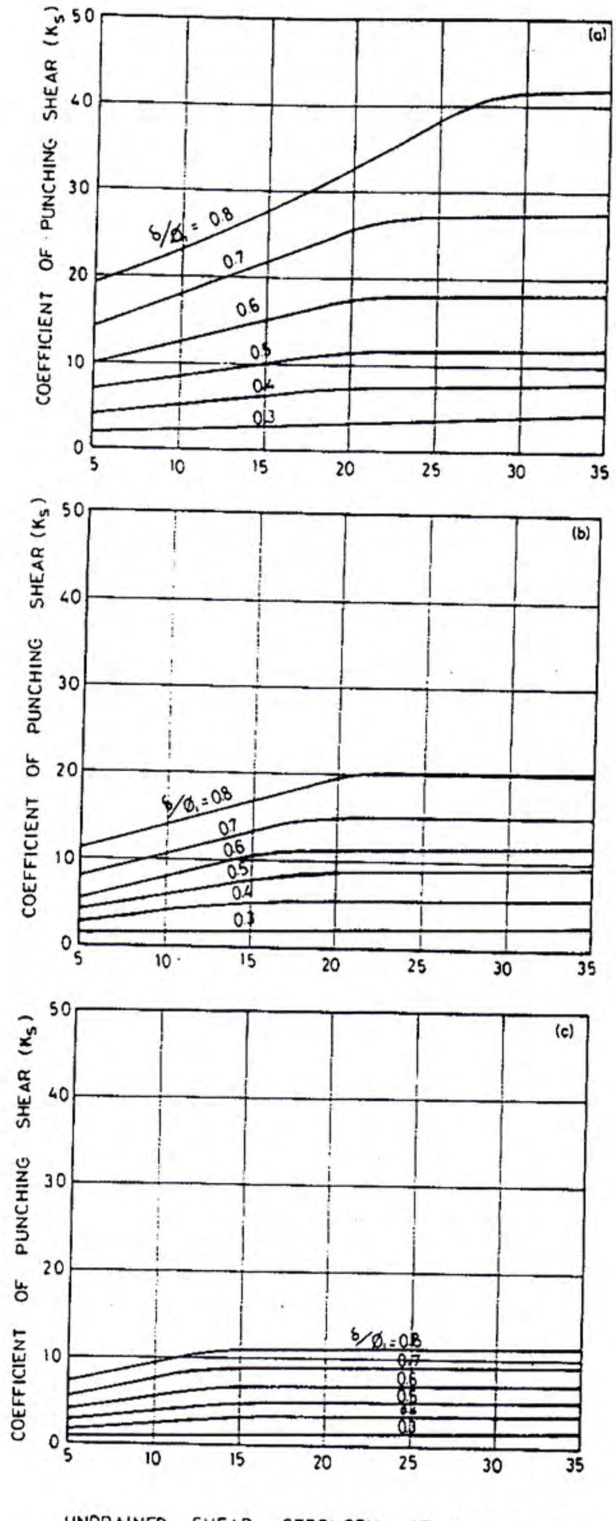


FIG. 4. Coefficients of punching shear: (a) $\phi_1 = 50°$; (b) $\phi_1 = 45°$; (c) $\phi_1 = 40°$.

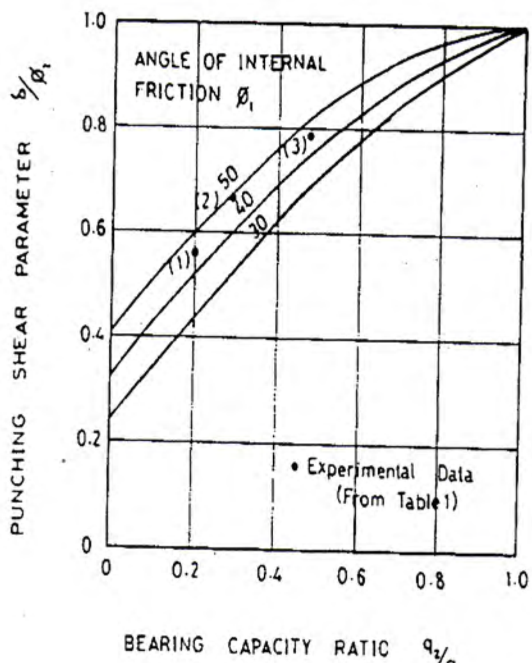
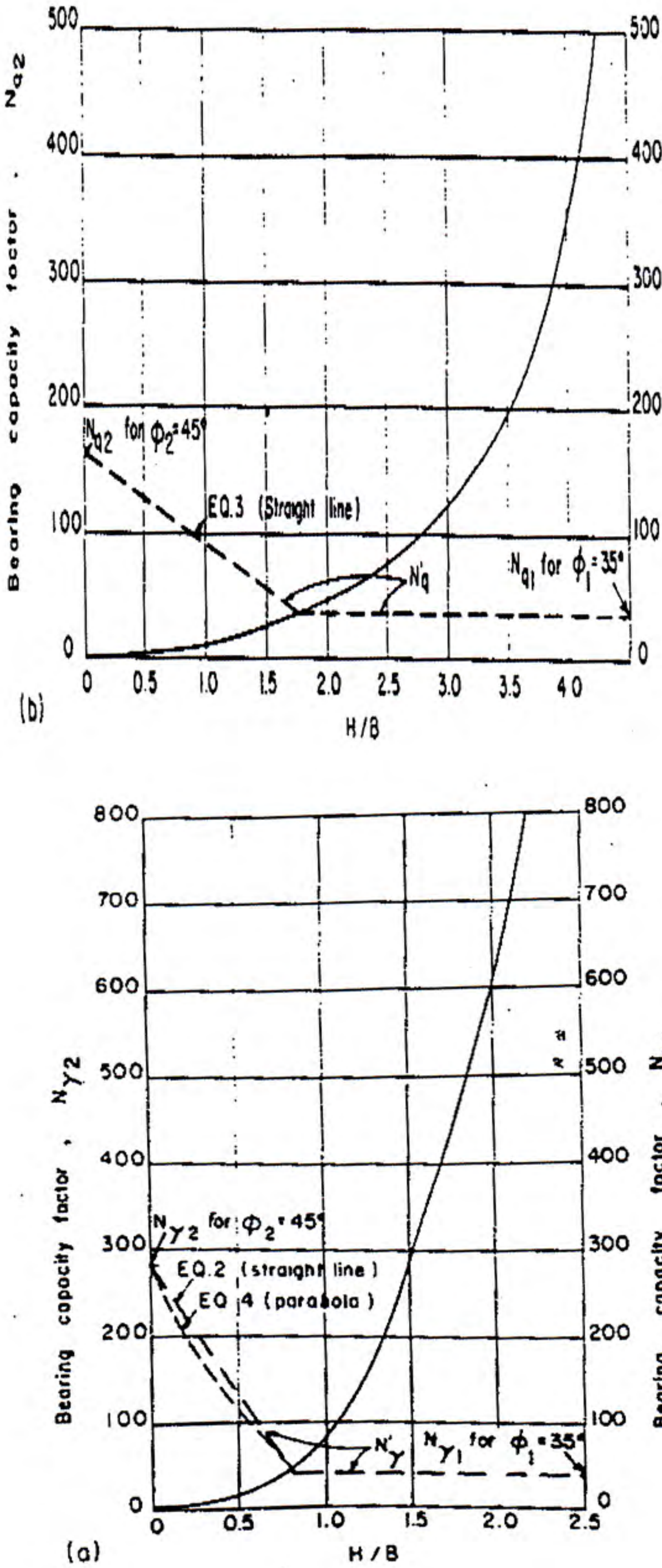


FIG. 3. Punching shear parameter.



Design charts for weak sand overlying strong sand

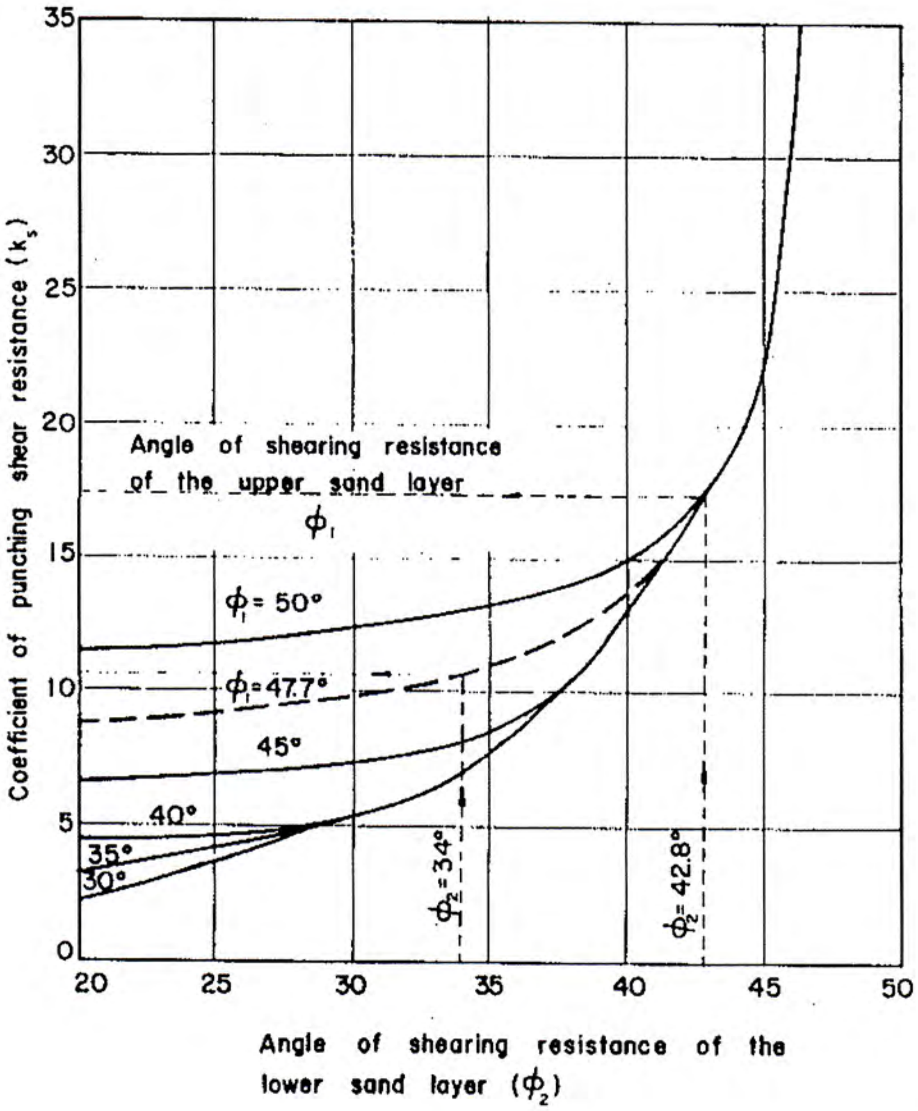


FIG. 8.—Desi[illegible] or Determining Coefficient of Punching Shear Resistance, K_s

Factor	Equipment Variables	Value
Borehole diameter factor (C_B)	65-115 mm (2.5 – 4.5 in)	1.00
	150 mm (6 in)	1.05
	200 mm (8 in)	1.15
Sampling method factor, (C_s)	Standard sampler	1.00
	Standard sampler without liner (not recommended)	1.20
Rod length factor (C_R)	3-4 m (10-13 ft)	0.75
	4-6 m (13 – 20 ft)	0.85
	6-10 m (20-30 ft)	0.95
	> 10 m (> 30 ft)	1.00

University of Asia Pacific
Department of Civil Engineering
Final Examination Fall 2016
Program: MCE

Course Title: Structural Design of Pavement — Course Code: 6505
Time: 3 Hours — Full Marks: 100

Answer any five (5X20=100)

1. A. Write five differences between Flexible and Rigid Pavement. (5)

   B. With a diagram explain layers of Flexible Pavement. (10)

   C. Define: i) Contraction Joint, ii) Construction Joint (5)

2. A. Write basic assumptions for analyzing flexible pavement by layered system. (5)

   B. A circular load having radius *6 in. (152 mm*) and uniform pressure *80 psi (552 kPa)* is applied on a two-layer system. The subgrade has elastic modulus *5000 psi* (*35 MPa*) and can support a maximum vertical stress of *8 psi (55 kPa)* . If the HMA has elastic modulus *500,000 psi (3.45 GPa*), what is the required thickness of a full-depth pavement? If a thin surface treatment is applied on a granular base with elastic modulus *25,000 Psi (173 MPa)*, what is the thickness of base course required? (7)

   C. A full-depth asphalt pavement having *8* in. (203 mm) thickness subjected to a single-wheel load of *9000 lb (40 kN)* having contact pressure *67 .7 psi (467* kPa). If the elastic modulus of the asphalt layer *is 150,000 psi (1 .04 GPa*) and that of the subgrade *is 15,000 psi (104 MPa)*, determine the critical tensile strain in the asphalt layer . (8)

3. A. What are the causes of stresses in slab for Rigid Pavement analysis. (5)

   B. How stresses due to friction effect Slab in Rigid Pavement. (5)

   C. Given a concrete pavement with a joint spacing of *25 ft (7 .6 m)* and a coefficient of friction of *1.5*, determine the stress in concrete due to friction. (5)

   D. Given $\Delta T = 60°F$ $(33°C)$, $\alpha_t = 5.5 \times 10^{-6}/°F$, $\epsilon = 1.0 \times 10^{-4}$, $C = 0.65$, and the allowable joint openings for undoweled and doweled joints are *0.05 and 0.25 in*., respectively, determine the maximum allowable joint spacing. (5)

4. A. A cement concrete pavement of thickness *20 cm*, has two lanes of *7.0 m* with a joint. The unit weight of concrete is 2400 kg/m^3. The coefficient of friction is *1.5*, allowable working tensile stress in steel is *1750* kg/cm^2 , bond stress of deformed bar is *24.6* kg/cm^2 . Design the length and spacing of tie bars. (5)

   B. Design size and spacing of dowel bars at an expansion joint of concrete pavement of thickness *20 cm*, the radius of relative stiffness is *90 cm*. Design wheel load *4000 kg*. Load capacity of the dowel system is *40 percent* of design wheel load. Joint width is *3.0 cm* and the permissible stress in shear, bending and bearing stress in dowel bars are *1000, 1500 and 100* kg/cm^2 respectively. (5)

C. An existing rural four-lane highway is to be replaced by a six-lane divided expressway (three lanes in each direction). Traffic volume data on the highway indicate that the AADT (both directions) during the first year of operation is *24,000* with the following vehicle mix and axle loads,
Passenger cars = 50% , 2-axle single-unit trucks (*12,000 lb/axle*) =*40%*, and 3-axle single-unit trucks (16,000 lb/axle) =10%.
Determine the design ESAL if the vehicle mix is expected to remain the same throughout the design life of 20 years, although traffic is expected to grow at a rate of 3.5% annually. Using the AASHTO design procedure, design a concrete pavement required for the design period of 20 years. P_i *4.5*, P_t *2.5*, S_c *=650* lb/in^2, E_c*= 5X106* lb/in^2, *k=130* lb/in^3, *J=3.2*, C_d *=1.0*, S_o *=0.3*, *R=95%*. Explain step by step design process. (10)

5. A. A six-lane divided highway is to be designed to replace an existing highway. Traffic survey conducted on year 2015 showed that AADT (both directions) in year 2015 is 6000 vehicles. It is expected that new highway will start its operation on year 2020. Traffic growth rate is 5% per annum. The percent of traffic on the design lane is 45%. Determine the design ESAL if the design life is 20 years and the vehicle mix is:
Passenger cars (*1000 lb/axle*) =*50%*, 2-axle single-unit trucks (*5000 lb/axle*) = *40%*, 3-axle single-unit trucks (*7000 lb/axle*) =*10%*.
For this six-lane divided highway Design the suitable flexible pavement using AASHTO Method consisting of an asphalt mixture surface with an elastic modulus of *250,000* lb/in^2, a granular base layer with a structural coefficient of *0.14* on a subgrade having a CBR of *10* and roadbed soil resilient modulus *15000* lb/in^2. Assume all m_i values =1, and the percent of traffic on the design lane is *45%*. Use a reliability level of *85%*, a standard deviation of *0.45*, and initial serviceability index *4.5* and terminal serviceability index *2.5*.Explain step by step design process. (10)

B. Write the general principles of Flexible Pavement design. (10)

6. A. Write the methods for determining roadway condition. (5)

B. Explain present serviceability rating and present serviceability index. (5)

C. What are the differences between profilometers and response type equipment for measuring roughness of pavement? (5)

D. How will you measure fatigue cracking, and pothole and understand their severity level? (5)

Required Charts, Tables and Equation

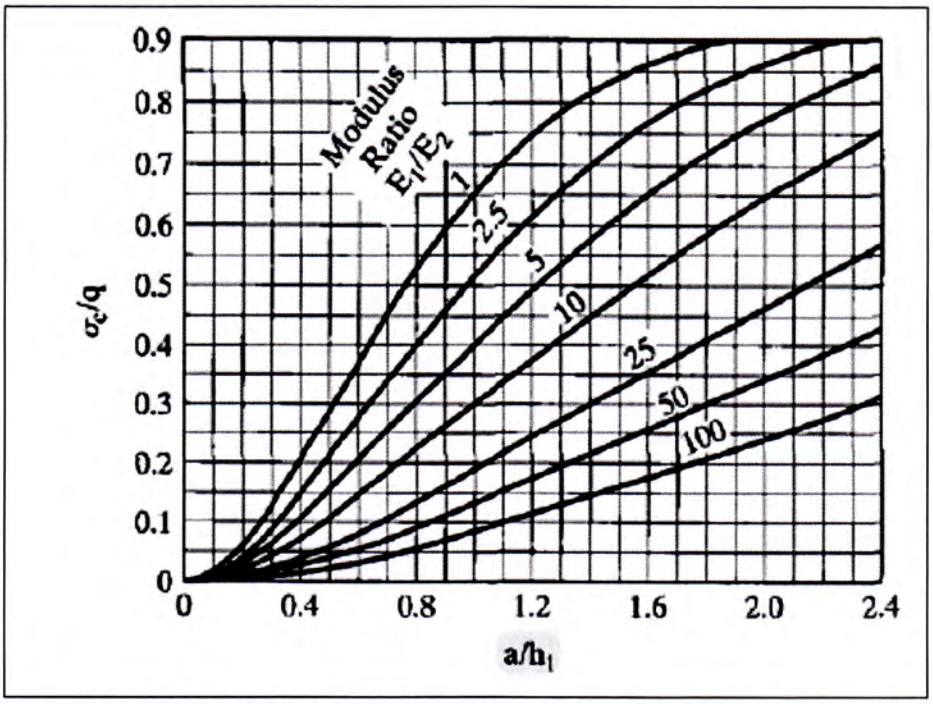


Figure 1: Vertical interface stresses for two-layer systems. (After Huang (1969b).

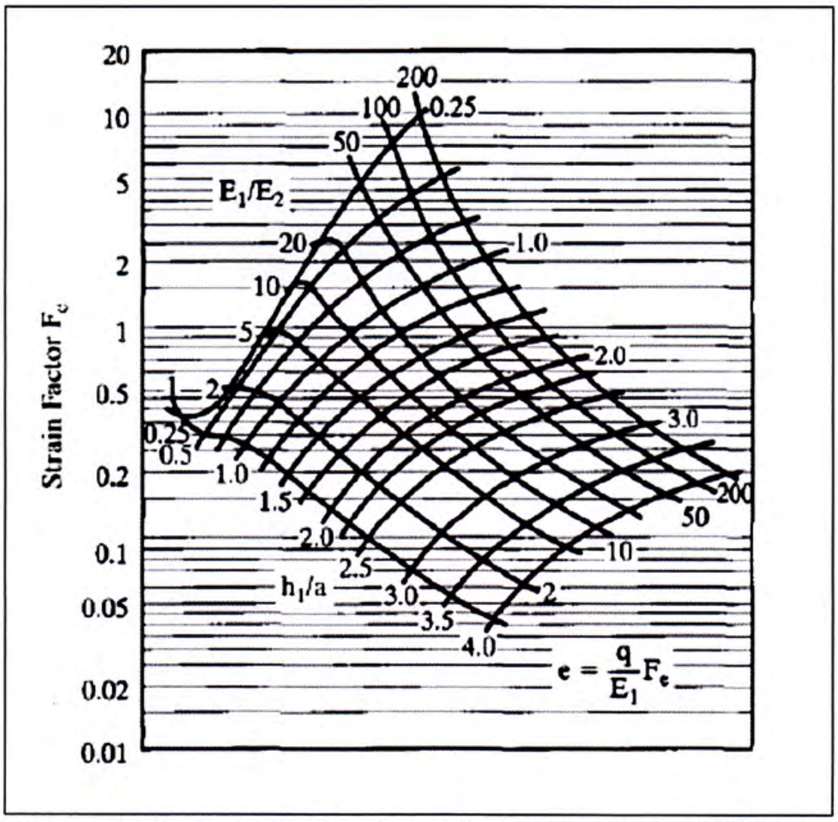


Figure 2: Strain factor for single wheel (After Huang (1973a) .)

$$\sigma_c = \frac{\gamma_c L f_a}{2}$$

$$\Delta L = CL(\alpha_t \Delta T + \epsilon)$$

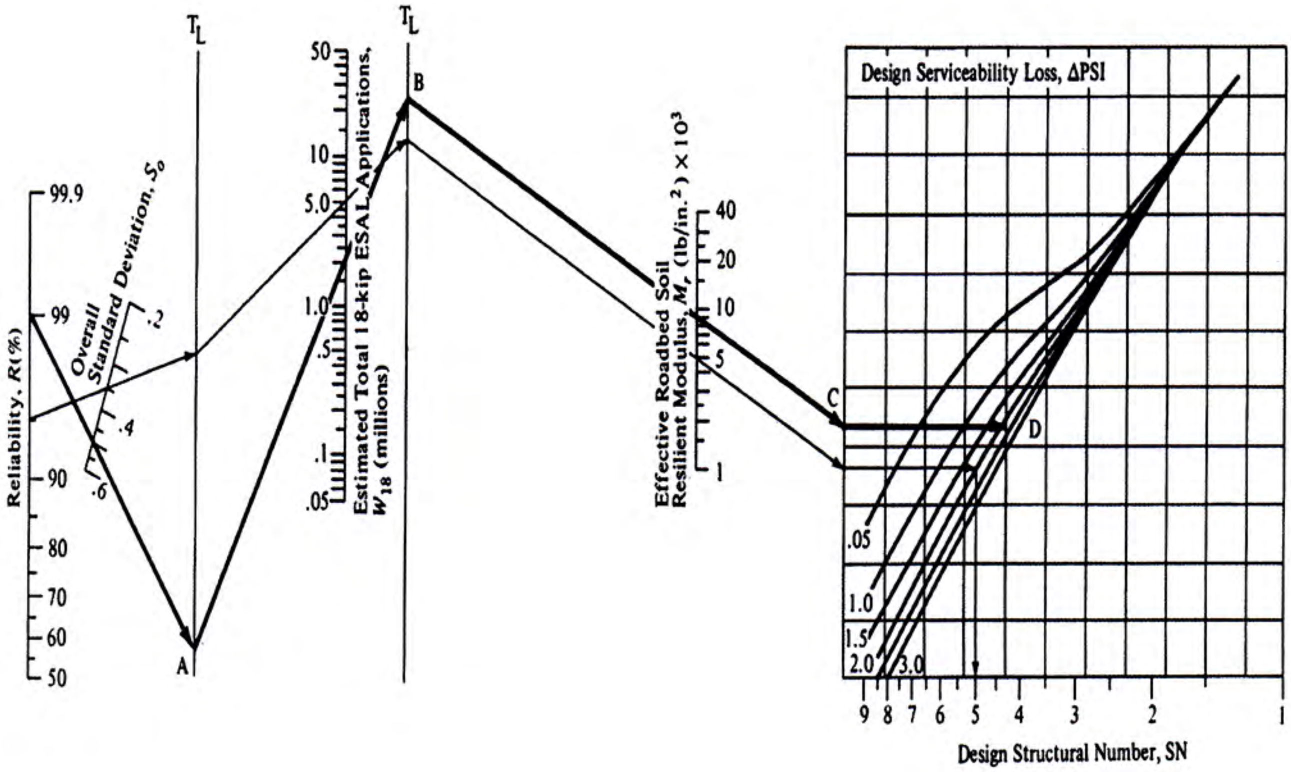


Figure 3: Design Chart for Flexible Pavements Based on Using Mean Values for each Input

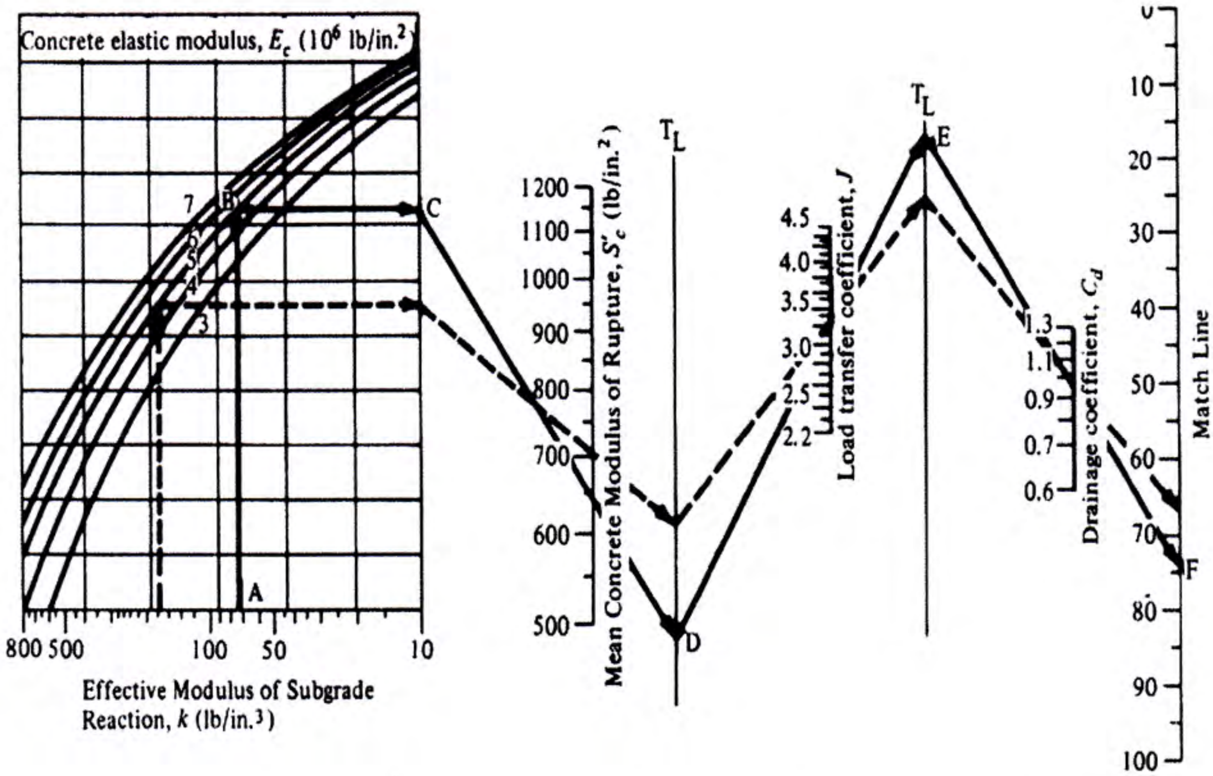


Figure 4: Design Chart for Rigid Pavement Based on Using Values for Each Input Variable (Segment 1)

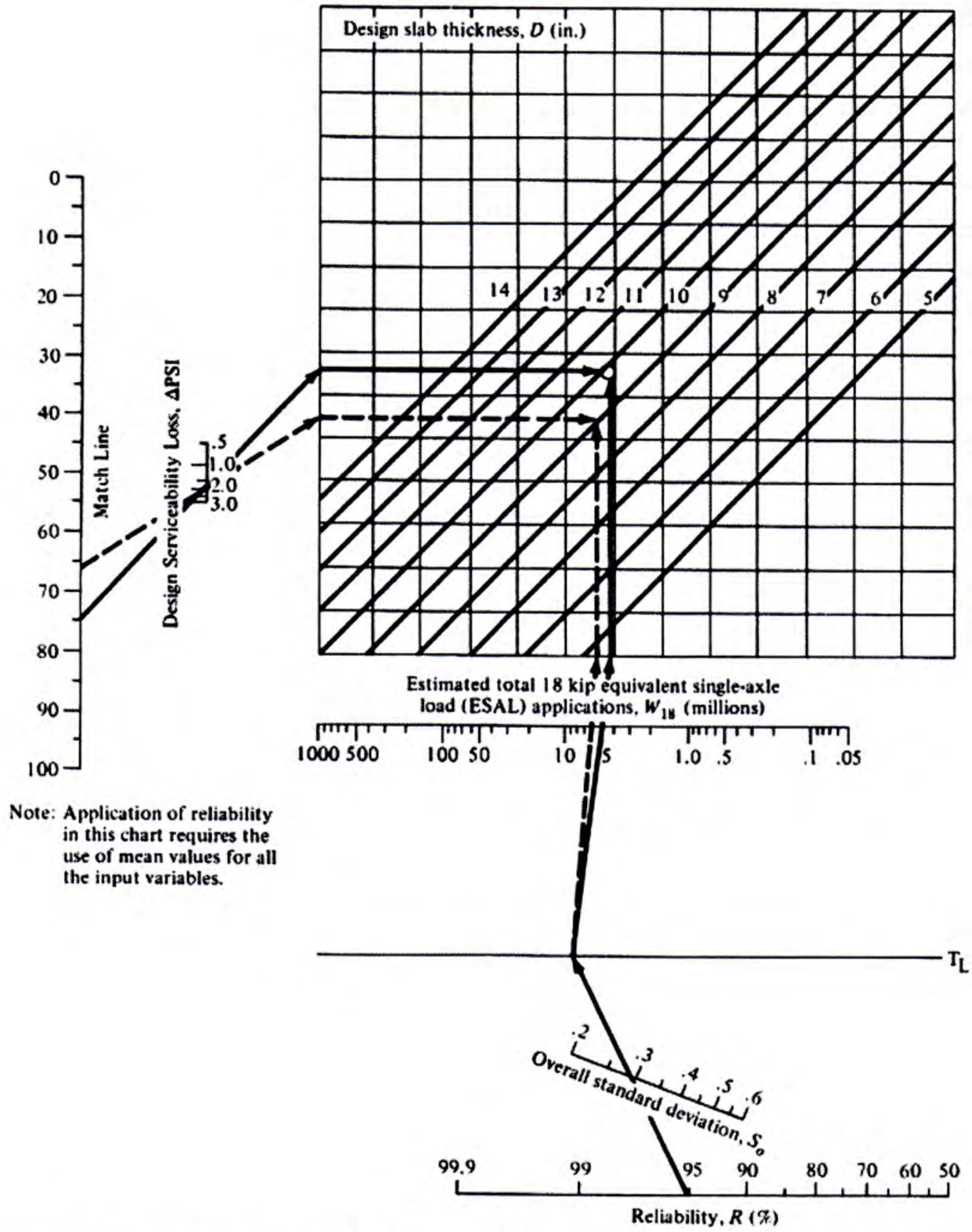


Figure 5: Design Chart for Rigid Pavement Based on Using Values for Each Input Variable (Segment 2)

University of Asia Pacific
Department of Civil Engineering
Final Examination Fall 2016
Program: MCE

Course Title: Advanced Theory and Design of Steel Structure — Course Code: CE 6110
Time: 3 (Three) hours — Full Marks: 250

There are 8 questions in this section. Answer all the questions.
Assume reasonable values for any missing data

1. (a) The currently proposed value of R_o for BRBFs for AISC 341-05 is lower than for any other steel seismic load resisting system. Why would this be? 3

(b) You have designed a pin ended, laterally supported class 1 (no local buckling), wide-flange beam to be fabricated from G 40.21-350W steel. Following the American Steel design standard, ASCE-7-05, you did your calculations using a resistance factor, φ, of 0.9. Now the structure has been erected and you have discovered that the grade of steel used was not 350W after all, but rather it is an imported product called 'Ultra-steel' that has all the chemical and mechanical requirements of American structural steels, but has nominal yield strength of only 330 MPa. Being concerned about this discovery, you feel that a quick check is necessary. Having taken CE-6110, you know that the resistance factor you used was based onβ= 3.0, using statistical mill data for American steels.

Your research reveals that the variation in the plastic modulus (a geometric parameter) is identical to that of American shapes, that is ρ_z= 0.99 and V_z= 0.038. However, the variation in the yield strength of Ultra-steel has a somewhat different character that does 350W, as shown by the statistics. You also know that the ratio of experimentally determined plastic moment capacity to that predicted using measured geometric and material properties has a mean value of 1.10 and a coefficient of variation 0.11.

i) Are you comfortable with your use of F_y= 350 MPa, with a resistance factor of 0.9? 10

ii) If the published value of the plastic modulus for the section that you have selected for your design is $1.0X10^6$ mm^3, and the expected mean mid-span moment over the life time of the structure is known to be 145 kN-m, with a standard deviation of 35 kN-m. Calculate the resulting reliability index, β as well as the resistance factor, φ, for design (i.e., using F_y= 350 MPa with Ultra-steel), required to achieve this reliability index (assume that α_R=0.55 still applies). 12

iii) For the loading in (ii), determine the probability of failure of the member during its design life. Comment briefly on the consequences of failure. 5

Given,
$\varphi_\beta = 0.0062\,\beta^2 - 0.131\,\beta + 1.338$
Calculated mean stress= 352.88 MPa
Standard deviation= 15.18 MPa
(Note: Tensile tests conducted at a strain rate of 500 $\mu\varepsilon$/s)

2. (a) Why is the true maximum stress in a steel tension coupon higher than the engineering stress near rupture? 2

(b) The beam shown in Fig. 2(b) is subjected to two vertical concentrated loads and a concentrated end moment. It undergoes elastic lateral-torsional buckling when $P = P_{cr}$ (consider it to be a factored load). Lateral bracing is provided to both flanges at both the vertical supports and the load points. To save your time, the support reactions are given in the figure.

i) Determine the parameter C_b for the beam shown in Fig. 2(b). 12

ii) Determine which segment of the beam is the critical one. 3

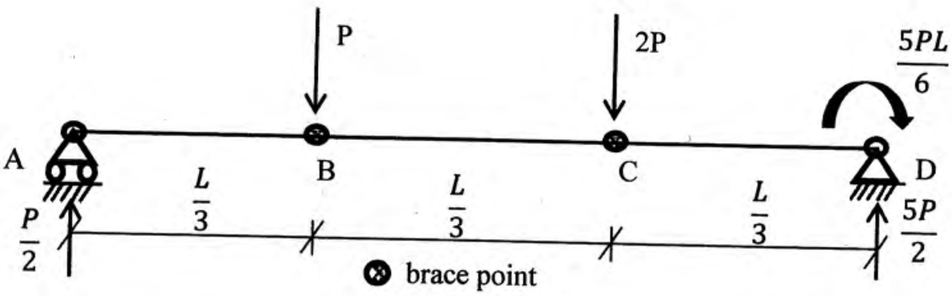


Fig. 2(b)

(c) Using column load table (AISC design manual), select the lightest W section for interior column of the frame shown in Fig. 2(c). Assume the column is braced at top and bottom in the plane perpendicular to the plane of frame. Use A992 steel and AISC/ASD specification. Initial size of the column can be obtained from AISC Design Manual. 23

Given,
Dead load= 150^k
Live load= 250^k
I_{beam}= 1000 in^4

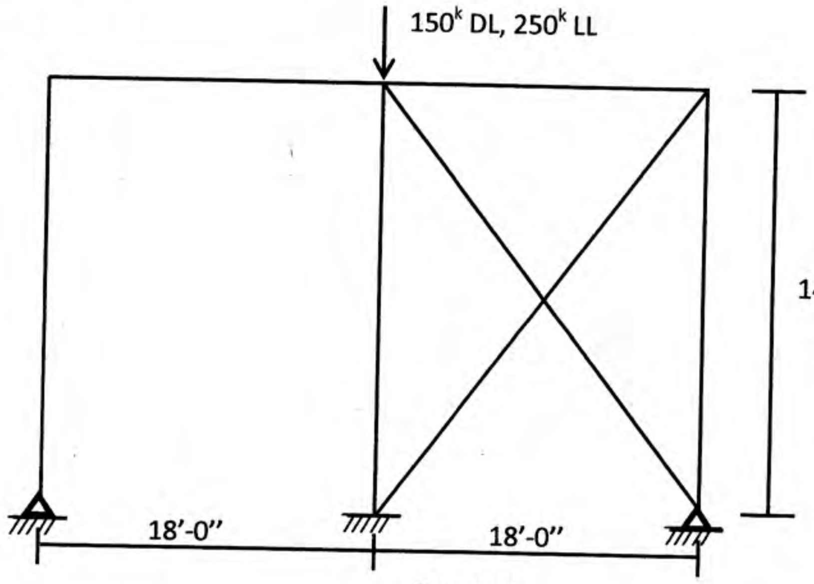


Fig. 2(c)

3. (a) Give two reasons why the resistance factors used for connections in most design standards are generally lower than those used for members. 2

(b) Why are "stress concentrations" that are known to exist around bolt holes in a tension member not accounted for in AISC 360 when checking the net section fracture mode of failure? 3

(c) Determine the equations for the stress- strain curve for the webless H-section with the residual stress for flanges shown in Fig. 3(c). The section will be used for a building column. The residual stresses are identical for both flanges. Also determine the column slenderness ratio based on $I_{x,eff}$, if the column starts buckling at an imposed compressive strain of 0.0015 in/in and construct the column strength curve. Given, F_y= 42 ksi, E=30000 ksi, K_x= 1.0. 25

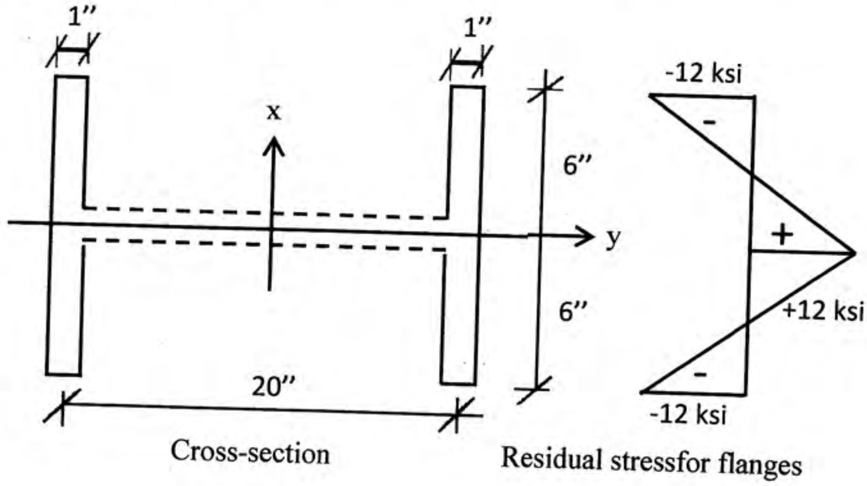


Fig. 3(c)

4 (a) The plan and elevation of a simple three storey steel building are shown in Fig. 4(a). Horizontal forces are resisted by exterior 3-bay rigid frames only (pinned at the base), as shown in the figure (the four interior columns are all leaning columns). The rigid frames on grid lines 1 and 4 are identical and each is symmetric about a vertical axis mid-way between gridlines B and C. The total (dead plus live) factored gravity area loads on the building, $W_{(D+L)}$ are 60 psf and 120 psf for the floors. Exterior wall gravity loads are supported at grade and therefore do not have to be carried by the steel frame. Interior non-load-bearing masonry walls brace each of the columns in the rigid frames continuously in the weak-axis direction (toward the inside and outside of the building). The factored wind load resisted by the frame on grid line 1, i.e., H_2, H_3 and H_4 are 11.5^k, 11.5^k and 5.75^k respectively. 30

Determine whether a W12 X 50 section of A992 steel is adequate at the location marked 1C2 (ground to level 2) in the figure according to AISC-LRFD method. Assume the column is adequate for shear.

An elastic first-order analysis of the frame on grid line 1 subjected to the factored gravity loads only has indicated a factored axial force in column 1C2 of 160 kip and a factored moment in this column that can be considered negligible.

An elastic first-order analysis of the frame on grid line 1 subjected to the factored wind loads only has revealed total lateral deflections (i.e., with respect to the original frame position) of 0.08 inch, 1.2 inch and 1.5 inch for levels 2.3 and 4 respectively. The resulting factored moment at the top of the column 1C2 (i.e., at level 2) is 250 k-ft (i.e., at level 2) and the factored axial force is negligible. Consider moment amplification factors.

(b) The designer of the building described in Question 4 (a) is now required to design a new building with identical specifications in a higher seismic region (zone 4 of v Proposed BNBC 2015). To keep the design forces comparable she decides to design the new moment resisting frames to meet the seismic design provisions accroding to AISC 341-05 and BNBC 2015. Check the new design (for seismic load combination only) of second floor beam (B2-C2) and bottom tier of the column (1C2) on grid line 1. If you find the beam is inadequate, redesign it. If you find that the column is inadequate, make a clear statement as to why it is so and suggest a remidial course of action (but do not redesign it). 20

The following member sizes have been selected by the designer and factored load effects under the seismic load combinations are also given:

Second floor beam: W10 X 45; V_u= 120 kip; M_u= 250 k-ft
Bottom tier of column (1C2): W14 X82; P_u= 210 kip

5. (a) What do you understand by weldability of steel? Mention the preferred alloy composition of good weldable structural steel. 3

(b) Determine the elastic shear stress distribution on a W14X120 beam subjected to a service load shear force of 65 kips acting for major axis bending. Also compute the portion of the shear carried by the flange and that carried by the web. 10

(c) The L152x102x13 member made of A36 steel (F_y= 36 ksi, F_u= 50 ksi) shown in the Fig. 5(c) is to be used as tension member. The holes are of standard size $\frac{3}{4}$ inch diameter A325 bearing type bolts (F_y=90 ksi, F_u= 120 ksi). Determine the factored tensile capacity of the member for the net section fracture failure mode only. Clearly indicate the failure path. Use the procedures from AISC 360-05. 12

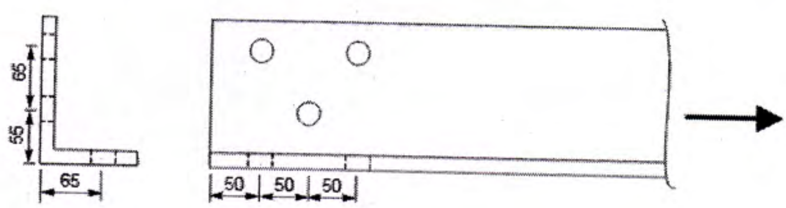


Fig. 5(c)

6. (a) Select the lightest W section to carry uniformly distributed superimposed dead load of 1 kip/ft and a live load of 1.35 kip/ft on a simply supported span of 40 ft. Adequate lateral support is provided along the span of the beam. The total deflection (for both dead and live load) is limited to L/240. Use A572 Grade 50 steel and follow LRFD method. 17

(b) Write short note on short column, intermediate column and long column and show their region in a column strength curve. 3

7. (a) A W 14X90 column transmits an axial compressive live load of 500 kip and dead load (excluding self wt) of 250 kip along with a small factored moment 50 k-ft on to a concrete base having a top surface area of 40 inch by 40 inch. Determine the size and thickness of base plate using A36steel (F_y=36 ksi, F_u= 50 ksi). The concrete base has f_c' = 3.5 ksi. Follow LRFD method. 13

(b) Derive the expression for moment amplification factor, B used in the design of beam-column. 12

8. (a) On a neat diagram, show what is ductility factor and over-strength factor. 2

(b) On a neat diagram, show specifically where you would recommend protected zones be designed for ductile moment resisting frames, SCBFs and EBFs. 3

(c) Write two advantages and disadvantages of CBFs? 2

(d) Why are continuity plates (stiffeners) required in columns of MRFs opposite a beam tension flange at a much lower tensile forces in seismic applications than in non-seismic application? 2

(e) On a neat diagram, show the possible plastic hinge locations for Steel Moment Resisting Frames (MRFs). 3

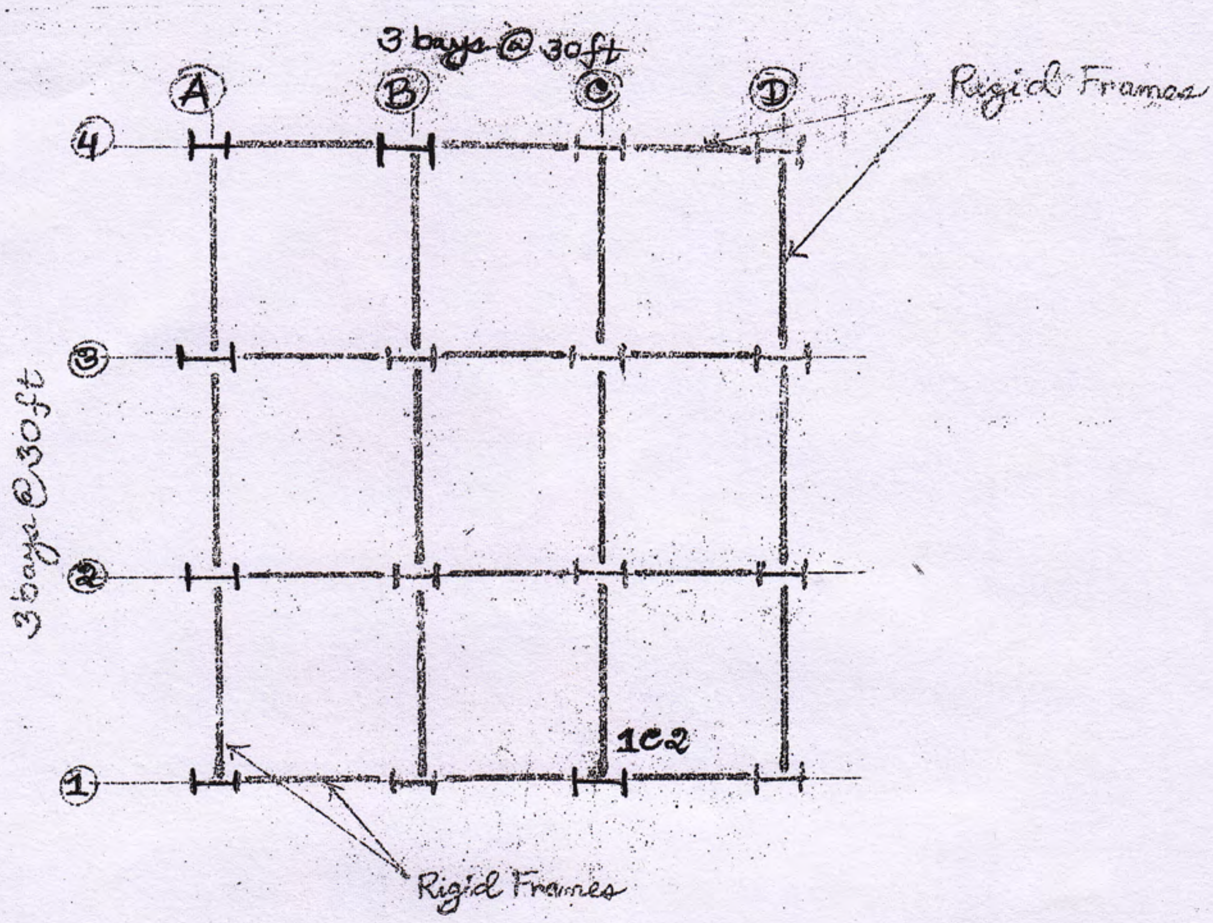
(f) Write few points with diagram on how to avoid shared forces between welds and bolts according to AISC 341-05. 4

(g) Write the desirable characteristics of earthquake resistant buildings according to the proposed BNBC 2015. 4

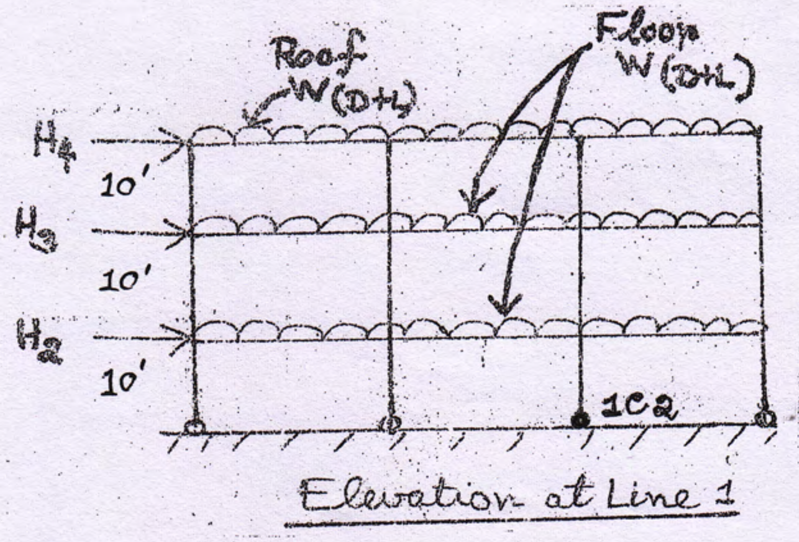
(h) On a neat sketch show the inelastic response of a Concentric Braced Frames (CBFs). 2

(i) Briefly discuss the energy dissipation mechanisms for MRFs, CBFs and EBFs. 3

(j) What are the main causes of Northridge Moment Connection Damage? How those limitations are addressed in the AISC 360-05 and AISC 341-05 for Moment Connection Design? 5



Plan View



Elevation at Line 1

Fig. 4(a)